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in front of me. I mention this because false stories of the lamentable occurrence, invented by Skardu coolies, were widely published.

It is gratifying to me that no coolies in my party were seriously injured or died on the glacier, for the Siachen is incomparably more difficult to travel over than any of the five great Karakoram glaciers, all of which except the Baltoro we know quite thoroughly. An especial danger for loaded coolies is water. In crossing the Siachen opposite Teram Shehr, a distance of about three miles, eleven glacial streams were met with this season. Three were at least ten feet wide and so deep that it was impossible to ford them after 11 A.M.

AMUNDSEN'S SOUTH POLAR BOOK*

REVIEWED BY

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Simultaneously with Captain Amundsen's Continental lecture tour have appeared his complete narrative in German and also the lecture itself save for the illustrations.†

The volumes of narrative contain as supplementary chapters: a preliminary discussion of the meteorological observations made at the winter station of Framheim, a brief statement concerning the rock specimens collected (all crystalline rocks), the oceanographical observations (by B. Helland-Hansen and Fridtjof Nansen), and, finally, the scientific proof of attaining the South Pole by Ant. Alexander. The work is dedicated "To the brave little company—my comrades—who one evening on the way from Funchal promised to stand by me in the conquest of the South Pole." It is introduced by Fridtjof Nansen, the polar explorer who designed the *Fram* and whose poleward drift in it made the vessel famous.

As is well known, it was Amundsen's plan to attain the North Pole in a drift across the Arctic pack ice by the method devised by Nansen and all but successfully carried out. When Amundsen was ready to sail, it was, however, with an inadequate outfit, due to a lack of the necessary funds. In August, 1910, as Nansen tells us, Amundsen's friends were surprised by a letter from him informing them that in order to secure the funds which had not been forthcoming at home he would first attain the South Pole. Says Nansen, "People were dumb—they did not know what to say. To gain the North Pole by way of the South Pole!" The great task of reaching the South Pole already accomplished, the doughty captain is now by means of lectures and editions reaping the golden harvest which is to send him fully equipped upon his Arctic quest in 1914.

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* Die Eroberung des Südpols. Die Norwegische Südpolfahrt mit dem Fram 1910–1912. Von Roald Amundsen. Einzige berechtigte Uebersetzung aus dem Norwegischen ins Deutsche von P. Klaiber. 2 vols. Fifteen maps and plans, 300 text illustrations and 8 four-color plates after oil paintings by Prof. W. L. Lehmann. J. F. Lehmanns Verlag, Munich, November, 1912. Mk. 22.

† "Meine Reise zum Südpol." *Zeitsch. Gesell. f. Erdkunde zu Berlin*, pp. 481–498, 1912. A translation of this paper appeared in the November *Bulletin*, pp. 822–838.

Victoria Land, King Edward VII Land, Coats Land and Wilkes Land being all preempted as starting points by the English, Japanese, German and Australian Antarctic expeditions upon the ground, Amundsen chose as his *point d'appui* the deep indentation of the Ross Barrier situated 404 statute miles distant from Victoria Land, 115 miles from King Edward Land and known as Whale Bay. On comparing the present outlines of the bay with the map of Ross made some seventy years before, Amundsen was overjoyed to find that while elsewhere the margin of this great area of shelf ice had suffered large changes, it had here remained practically unaltered. Such an indication that the shelf ice is locally stranded in a shallow of the sea was confirmed by the observation of surface fractures and irregularities. The winter quarters of the expedition, Framheim, could therefore be established here with every assurance that this main depot of supplies would remain undisturbed.

The decision to lay out the route as nearly as possible due southward from this base proved to be in the main a wise one. Traveling over the generally even surface of the shelf ice is naturally much easier than over the high ice plateau, both because breathing is so much less difficult and for the reason that depots of provisions are separated from the base by no such serious obstacles as the steep and crevassed margin of the inland ice. Framheim was not only some seventy miles nearer the pole than the base of any of the other expeditions, but the shelf ice was found to extend a full hundred miles nearer the pole than along the Shackleton-Scott route. On the other hand, the southeasterly trend of the newly discovered Queen Maud mountain range—apparently a continuation of the Alexandra range in Victoria Land—brought Amundsen's due southerly course for a relatively long distance within the crevassed and otherwise disturbed steeper slopes on the margin of the inland ice. Instead of mounting the slope directly, as did Shackleton where the trend of the ranges favored such a course, Amundsen crossed this difficult zone diagonally. This fact and the trend of the near-by mountain ranges explain some irregularity in wind direction which held up to near the 88th parallel. Here the highest point in the course was reached at an altitude of 10,578 feet, though it was only by consecutive instrumental readings that an extremely slight descent from this position could now be detected. From Shackleton's observations it is evident that the higher surface of the ice dome lies to the westward of his route, and these results must therefore be interpreted as due to the course crossing a radial line upon the surface.

Perhaps the most interesting scientific result of the expedition was the entry near the 88th parallel upon a region, in Amundsen's belief, of permanent calm or light winds and generally clear weather. Here the snow surface is smooth with no indications of drifting. A tent pole, 6.56 feet in length, was thrust down into it to the end without encountering any hard layers. During the fortnight spent within this area the sky was clear except on two days when at intervals snow flurries obscured the sun. The light winds were throughout from the southeast. Once, when some distance within the border of this area, during a short spell of gray weather when it was impossible to see, the course had to be kept by compass. "But, as usual, it brightened again suddenly and our vast surroundings spread out bright and warm around us. We had to take off everything—or nearly everything—and yet the perspiration poured off us." Again, on Christmas Day in latitude 88° 23′ the weather was changeable, at one time clouded, then bright and clear.

On the return the inbound trail was followed and the depots of provisions easily found. The precaution had been taken to set at each station a series of marks running at intervals of a kilometer (.623 of a mile) for a distance of five and a half miles on either side of the course. These marks were pillars formed of snow blocks each tipped by a flag so marked as to give its location in reference to the route. At all stations south of the 80th parallel the route was marked by pillars each built of 60 blocks and numbering 150, a task involving the cutting of 9,000 snow blocks. This contribution to the technique of travel on both inland and shelf ice is likely to be taken advantage of by future explorers, since its merits were so fully demonstrated.

Amundsen's route to the pole measured 864 miles and the complete journey lasted 99 days. The return was made in 39 days, corresponding to an average of about 22 miles per day.

To the generally observed even surface of the Ross Barrier along the route, two exceptions must be mentioned: one, that already noted near Whale Bay, where the shelf ice is evidently aground on a shoal; and the other between the 81st and 82nd parallels, where crevasses and unevenness were likewise encountered. A happy discovery during fine weather on the return has explained the disturbance at the more southerly of the two areas. When near latitude 81° 20′ there was seen far off to the southeast beyond the irregular crevassed surface, a high land area and two white peaks. That this discovery combined with that of the low mountain range trending northeast near the inland-ice margin precludes a separation of East from West Antarctica cannot, however, as yet be assumed. Amundsen's map indicates clearly that two degrees of latitude on either side of this newly discovered land is still unknown. In fact, press dispatches have announced that the Japanese explorer Shirase has proven the separation. Later, and more definite information from both Filchner and Shirase will therefore be eagerly awaited.

A party commanded by Lieut. Prestrud crossed the Barrier near its margin to King Edward VII Land, and on reaching it ascended a rocky elevation 984 feet in height, which in honor of Capt. R. F. Scott was named Scott's Rocks.

The daily meteorological observations were carried out at Framheim, more than 100 miles from the nearest land mass. The results show that the winter was about 12° C. colder than at McMurdo Sound, the station of the English expeditions in Victoria Land. August was the coldest month, with an average temperature of —44.5° C. For fourteen consecutive days of this month the temperature sank to below —50° C., the minimum being —58.5° C., and the maximum for the month —24° C. In summer the temperature never rose above freezing and fell on one occasion to —50° C. The calculated annual temperature is —26° C., which Amundsen thinks the lowest anywhere observed.

The relative moisture of the air for the winter months had an average value of 90 per cent. and was at a minimum in November with 73 per cent. For the absolute moisture the highest monthly average was 2.5 mm. (in December) and the lowest 1 mm. (in August). The maximum daily value was 4.4 mm. (on December 5th).

Measured wind velocities ranged between 1.9 meters per second in May and 5.5 meters in October, an average of but 3.4 meters for the ten months. This low figure is explained by the few stormy days—

only 11 in all. As regards wind direction, the frequency in percentage shows that easterly winds greatly predominate over others (31.9 per cent.), with southwesterly and southerly winds next in order (14.3 and 12.3 per cent.), and calms prevailing a fifth of the time (21.3 per cent.). Southeasterly winds were especially rare. On examining the map it is seen that the position of Framheim with reference to inland ice sufficiently explains these facts. The near mass of plateau-ice is in King Edward Land due eastward, while the more distant ice dome of Victoria Land lies to the southwestward, the winds from the latter suffering an amount of deflection through earth rotation which is dependent upon their intensity.

The air pressure was notably low and constant. Oceanographical observations of great value were carried out during the voyage of some 8,000 nautical miles, and measurements were made at no less than sixty stations.

In a long summary of Antarctic exploration (no less than 112 pp.), which introduces the narrative, it is worthy of note that but fifteen lines are vouchsafed to Admiral Wilkes, the discoverer of the Antarctic Continent. The tenor of this reference is more remarkable even than its length. We quote (pp. 44-45):

"The American naval officer, Lieut. Charles Wilkes, left America on August 18th, 1838, with 6 ships, 83 officers, 12 scientists, and 345 men. On February 17th, 1839, this entire powerful Antarctic fleet lay in the harbor of Oranien in the southern part of Tierra del Fuego. From there the work was distributed among the different ships. Of the results of this undertaking it is difficult to say anything definite. So much is certain, that different explorers have in several places sailed over Wilkes Land. What may be the cause of these erroneous maps it is now impossible to judge. From the effect of the entire voyage it appears, however, that it was gone into as a serious undertaking."

One cannot believe that the above statements were written after a study of Wilkes's report. They sound rather like an echo to some of the hostile English criticism which had its beginning, as is well known, in the bitter resentment of Sir James Ross when he found that Wilkes had forestalled him in the discovery of Antarctica. It is true that both ends of the long stretch of coast line and barrier skirted by Wilkes (some 1,500 miles) have been sailed over; the eastern extremity by Ross, Borchgrevink and Scott in turn, and the western by the Australian explorer, Mawson. The latter has now, after three-quarters of a century, confirmed for the most part the map of the American explorer, and eminent authorities upon the Antarctic who are more lenient than Amundsen (such as Dr. H. R. Mill, Dr. W. S. Bruce and Professor von Drygalski) have found in the almost continuous storms and fogs which Wilkes encountered and in the nature of his unstrengthened ships, a sufficient explanation of the inaccuracies in his map. The wavy lines, almost a repeating pattern, which Wilkes entered upon the map for coast, is in itself sufficient indication that he regarded it as approximate only, masked as it generally was by barrier and huge bergs; but his series of soundings, through establishing the existence of a marginal shelf, confirmed his discovery of the land.

Amundsen himself, in entering upon his own map the extension of the Queen Maud Mountains, has indicated a series of peaks extending 150 miles from a single point of observation situated upon the domed surface of the inland ice, and by a conventional symbol not unlike that of Wilkes he has continued the range another fifty miles into the distance. If future exploration should prove that he has been too optimistic in adding the more remote fifty miles of the range, no one would be warranted in saying of his expedition, "it is difficult to say anything definite."

The edition as a whole is well gotten up, but the paper and text illustrations as well as the low price, indicate that the work is intended for a large general sale and not for a library edition. An English edition is to be issued by Murray and an American by Dutton.

NOTES ON THE DESCRIPTION OF LAND FORMS.—VIII*

The Relations of Geography to Geology.

THE TERTIARY GRAVELS OF THE SIERRA NEVADA OF CALIFORNIA. By Waldemar Lindgren. *Professional Paper 73,* U. S. Geol. Survey, Washington, 1911.

The greatest contribution to the regional geography of the United States comes at present from the U. S. Geological Survey, in the form of reports, maps and folios. It is not surprising that a large part of this information, in so far as it is presented in words, should be geologically rather than geographically phrased; that is, that it should be worded in such a way as to turn the reader's attention more to the past history of the earth—the proper domain of geology—than to the present condition of its surface—a proper domain of geography;

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* Professor Davis's earlier contributions to the *Bulletin* under this title appeared in Vol. 42, 1910, pp. 671-675 and 840-844; Vol. 43, 1911, pp. 46-51, 190-194, 598-604, 679-684 and 847-853.